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# The Relationship Between Hydropower Energy Consumption and Economic Growth

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## Abstract

This paper will analyse the relationship between economic growth and hydropower energy consumption. According to the results of the short run causality, there is evidence to support the growth hypothesis in OECD countries with high incomes. There is evidence to support the conservation hypothesis for Brazil, Finland, France, Mexico, the U.S. and Turkey. The unidirectional causality goes from economic growth to energy consumption and suggests that the policy of conserving hydropower energy consumption may be implemented with little or no adverse effects on economic growth in less energy-dependent economies.

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*Keywords:* Economic Growth, Hydropower Energy Consumption, ARDL

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## 1. Introduction

Pollution caused by non-renewable energy is an important issue because humans are facing the dual pressure of economic growth and environmental protection (See Zhang et.al: 2011).

Pollution caused by non-renewable energy revealed the dual pressure of economic growth and environmental protection (Zhang et.al 2011). In the late 1980s, the analytical paradigm was altered with concerns about environmentally sustainable economic growth. Sustainable economic growth policies are based on the level, quality and management of renewable and non-renewable natural resources. The states of the environment depends on the level and growth of pollution or waste streams, the environment's natural assimilation of pollution or through clean up expenditures. As the concept of sustainable development emerged with the rise of green movements, hydropower energy became popular.

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As electricity demand especially grew, the number and size of non-renewable energy increased. Early hydropower plants were much more reliable and efficient than the non-renewable plants of the day (Baird:2006; Kumar et.al:2011). Unlike non-renewal energy sources, renewable hydropower energy can continuously produce energy (Margeta and Glasnovic. 2011).

According to the report of world bank (WB:2009), hydropower has a powerful contribution to make to regional cooperation and development and to the allocation of increasingly scarce water resources and it is complex and brings a range of economic, social and environmental risks (Schumann et.all R.2010).

This paper, will analyse the relationship between economic growth and hydropower energy consumption. The next section of the study will present studies about hydropower energy consumption and economic growth in the literature. Econometric theory and methodology is identified in the third section. The fourth section consists of the empirical results while the last section includes conclusions and policy implications.

## **2. The Literature of Energy Consumption and Economic Growth**

Kraft and Kraft (1978), Berndt (1978), Akarca and Long (1980), Yu and Hwang (1984), Yu and Choi (1985), and Erol and Yu (1987) were among the first researchers examined the relation between GDP and energy consumption. In pursuit of their work, many paper analysed the relationship between energy consumption and economic growth. As result of these papers, it was obtained the different result on direction of causality. Different results on direction of causality allowed for four hypotheses: 1) the “neutrality hypothesis”; 2) the “conservation hypothesis”; 3) the “growth hypothesis” and 4) the “feedback hypothesis”.

The literature about the causal relationship between hydropower energy consumption and economic growth is very little when compared with the number of papers on other forms of renewable energy.

Sadorsky (2009) examined the relationship between renewable energy consumption and real GDP for 18 emerging countries and determined that an increase in real GDP should have a positive impact on renewable energy consumption.

Chien and Hu (2008) used the structural equation modeling approach to show the effects of renewable energy on the GDP of 116 countries. They determined that renewable energy has a positive and significant effect on capital formation and that there are relationships between renewable energy and GDP through the increase in capital formation. Chien and Hu (2007) examined the effects of renewable energy on the technical efficiency of 45 countries in 2001 and 2002. They found that the technical efficiency in OECD countries was higher than non-OECD countries, but non-OECD countries have a higher share of renewable energy.

Solarin and Öztürk(2015) examined the relationship between hydroelectricity consumption and economic growth in seven Latin America countries including Argentina, Brazil, Chile, Colombia, Ecuador, Peru and Venezuela. Their results determined long run bidirectional causality between hydroelectricity consumption and economic growth in Argentina and Venezuela. There is the evidence for long run unidirectional causality from hydroelectricity consumption to economic growth in Brazil, Chile, Colombia, Ecuador and Peru.

Bildirici (2015) investigated the relationship between CO2 environmental pollution, hydropower energy consumption, and economic growth in for Austria, Belgium, Denmark, Finland, France, Germany (1970–2011), Iceland, Italy, Ireland, Portugal, Spain, Sweden, Switzerland (1981–2011), Turkey, and the United Kingdom utilizing the ARDL method in the period from 1961 to 2011. According to her causality results, for Germany the conservation hypothesis determines the unidirectional causality running from GDP to hydropower energy consumption. For Austria, the growth hypothesis suggests unidirectional causality running from hydro energy consumption to GDP. For the United Kingdom, the neutrality hypothesis was determined. For other countries, a bidirectional causality hypothesis was determined.

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